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April 2014

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The Neolithic Revolution and Human Societies: Diverse Origins and Development Paths

ABSTRACT

Many economists have recently tried to explain the diverse levels of economic development of countries by studying their trajectories during past eras and in recent history. Special attention has been given to the influences on contemporary societies of relevant developments in prehistory and more particularly, those arising from the Neolithic revolution, i.e. the transition from foraging to farming. This transition from simple to complex hunting and gathering and then to farming is a sequence couched in social evolutionary terms. It suggests a pattern of progressive development resulting in increasing cultural complexity. In this evolutionary scheme, simple hunter-gatherers develop into complex hunters and collectors, whose critical economic decisions are a consequence of climatic changes that inevitably lead them to irreversibly adopt agriculture. Although this pattern of development is widely accepted, we challenge it. Studies of past and recent hunting and gathering societies show an incredible diversity of human social organization through time. Similarly, the various centers where agriculture started during the Neolithic period display great diversity in terms of their genesis, nature and consequences. The nature of the spread of agriculture from the Levant to Europe displays diversity. Demic diffusion and cultural diffusion were both present, and generated a variety of diffusion processes. This diversity of human societies is not easily accounted for by social evolutionary processes; indeed, people's understanding of the world directly influences the economic decisions they make. The development of agriculture eventually generated an economic surplus. This (combined with increasing social and economic inequalities), another feature of the Neolithic revolution, led to economic

growth and therefore to the long-term dominance of agropastoralists societies. Inequality (the appropriation by dominant classes of the economic surplus generated by agropastoralism and by stemming economic developments) was therefore a necessary early condition for increasing the chances of the survival and development of these societies; otherwise they would all have been caught in the Malthusian trap.

Keywords : hunter-gatherers, agriculture, Neolithic transition, demic diffusion, imitation, economic surplus, social and economic inequalities, social evolutionary theory.

JEL codes : N00, N5, O10, Q10.

The Neolithic Revolution and Human Societies: Diverse Origins and Development Paths

1. Introduction

It is widely agreed that before the Neolithic revolution, food procurement was provided by hunting and gathering. Despite this well identified mode of subsistence, there is no agreed vision of what was the nature of the economy and the society of hunter-gatherers. Nevertheless, past and present HG (hunter-gatherer) societies are diverse: some simple, others complex; some are affluent and others experience poverty. This diversity of HG societies and their associated economies must be taken into account in studying prehistory and in attempting to explain the past long-term path of economic development of current nations. The nature of HG societies set the initial conditions for the Neolithic revolution. Their diversity indicates why all HG societies did not follow the same development path. Diverse starting points (and subsequent events) have resulted in different types of Neolithic revolutions and subsequent development paths.

During the Neolithic period, agriculture started independently in at least seven different global locations and there were no linkages between these centers. Agriculture commenced, therefore, in very different ecogeographic contexts. This is confirmed by the diversity of plants and animals that were first domesticated in each center as well as by the diversity of climate and ecosystems in each of these centers. This diversity helps to explain why there is no unique or unified theory of the Neolithic transition and why different centers followed unlike development paths. Beyond this heterogeneity of resource endowments, two different theories of the Neolithic revolution exist. The first is based on social evolutionary theory and

hypothesizes the shift from foraging and hunting to farming is the result of human adaptation to external shocks, such as the ecosystem transformations induced by climate changes. The second one is based on a cultural and historical vision and adopts the view that the start of agriculture is a result of human decisions taken endogenously. This latter school, recognizes the presence of external shocks but their influence is not considered to be decisive or are believed to have only second-order effects on human behavior.

The geographical spread of agriculture from its original centers is particularly well documented for the diffusion of the Neolithic revolution from the Levant to Europe and into Asia Minor. Two main explanations can be found in the literature. The demic diffusion model assumes that the spread of agriculture is a consequence of migrations by farming communities. These population movements may have been triggered by a variety of factors. Push factors might have included increasing population pressures or local climate changes in areas where agriculture first began. Pull factors might have included the prospect of more productive agriculture in new territories. If this theory applied, its implication is that farmers settled all the European continent in approximately four millennia. The cultural diffusion model considers that European HG were converted to agriculture by the exchange of ideas and techniques related to the domestication of plants and animals. Trade and social interaction were probably the main vectors of this cultural diffusion which was therefore based on cooperation and contact between HG and farmers. In our view, it seems likely that both processes drove the diffusion of agriculture.

With the adoption of agriculture, people were able to produce their food and eventually could get an economic surplus. This surplus resulted in major changes in the economic structures and the social development of human communities. This surplus supported an increased human population, and provided the means for the eventual emergence of villages, towns and

cities. Indeed, as food scarcity decreased with the development of agriculture, the division of labor became more intensive. The latter resulted in increased trade and the development of other economic activities, e.g. handicrafts, as well as the development of extra economic activities related to art, religion and education. Despite the increase of the population induced by greater food production, the existence of an economic surplus led to economic growth in most places where the Neolithic revolution occurred. Nevertheless, in some societies, the agricultural revolution seems to have been accompanied by increasing social and economic inequality. Although such inequality existed in some HG societies, it was magnified in several Neolithic societies. The upper class, therefore, was able to accumulate very large surpluses for discretionary expenditure following the agricultural revolution and later development. Although some of these expenditures were purely motivated by status competition, many of them were devoted to collective tasks and buildings, i.e. to the production of some kind of public goods. The latter have supported the development of agriculture (e.g. the implementation of irrigation systems), as well as the development of cities and of trade (e.g. road construction and the introduction of money). In other words, the emergence of an economic surplus and accompanying social and economic inequalities during the Neolithic period contributed to economic growth[1] and the growing dominance of agropastoralists societies exhibiting both these attributes.

Most of the literature on the development of the economy and of human societies is based on a linear vision of history. Founded on the social evolutionary theory, it considers that societies evolve from simple forms to complex ones. In this approach, the rise of agriculture during the Neolithic period is a crucial step in explaining the various levels of economic development of current countries. However this vision can be challenged. As demonstrated by various examples, the shift to agropastoralism is not a necessary nor a sufficient condition

[1]C.A. Tisdell (2013, Ch. 7).

for human societies to show some development. Nevertheless, once agriculture became the dominant mode of production, rather than hunting-gathering, it permitted a huge increase of population size and generated an economic surplus. When this surplus was combined with social inequality, it provided scope for increased capital accumulation and was a possible basis for continuing economic growth. Whether or not the latter occurred, depended on how the dominant class used the economic surplus they appropriated from dominated individuals.

The paper is organized as follows. The diversity of past and recent hunter-gatherers societies is presented in section 2. Section 3 is devoted to the early start of agriculture in various centers located worldwide. Some conditions (especially economic ones) required for agriculture to emerge are detailed in section 4. Section 5 considers alternative explanations of agriculture's spread from the Levant to Europe. The consequences of the existence of an economic surplus provided by agriculture are analyzed in section 6, particularly with respect to the occurrence of economic growth. The linear vision of economic development, which is dominant in the literature dealing with economic history and which is founded on the social evolutionary theory, is challenged in section 7. Section 8 concludes.

2. The Diversity of Hunter-Gatherer Societies and The Changing Popularity of their Representation

Although hunting, fishing, gathering and collecting were typical means of subsistence in the pre-Neolithic period, it is the only feature common to all hunter-gatherers societies. The literature on prehistory has identified at least three different types of hunter-gatherer' societies. This explains why it is difficult to understand completely why the so-called Neolithic revolution occurred. Indeed, the starting point of this revolution, i.e. the HG society, is in fact not unique. Its features depend on the period studied, the areas (or

ecosystems) where people lived and the representations of these features also vary with the vision of modern scientists about human evolution.

Until the 1960s, HG societies were mainly – or exclusively – seen from Hobbes' perspective. Indeed, Hobbes[2] claimed that before the appearance of modern governments and states, life was "solitary, poor, nasty, brutish and short". Such a vision has been obviously adopted by various authors; one of the most famous of whom is E.R. Service (1966). In his view, the economy and society of HG – thereafter called "simple HG" - are described by four features[3]. People were poor. They were roaming all the time to get food and their technology, hunting and gathering, resulted in low productivity. Their technology also constrained them to have a nomadic way of life in order to avoid starvation. Since they were nomads, it was impossible for them to have more than one child per family every four or five years. As a result, their population had a low density and they were organized in small groups or "bands": each band consisting of at most 100 people. Finally, since their method of food procurement provided no surplus due to their deficient technology and the lack of division of labor, their society was assumed to be egalitarian. Until the 1960s, most people agreed with this vision for many reasons. The main one probably was that it helped to reinforce the view that the Neolithic revolution brought about a shift from societies of simple HG (or primitive savages) to superior ones involving civilized agropastoralists; the type of societies in which these views were being propagated. It provided a basis for feelings of superiority of agriculturally based societies which had evolved in the 17th, 18th and 19th centuries in Europe and which underwent further development with the advent of the Industrial Revolution.

In the 1960s, this vision was challenged by the results[4] of ethnological studies of HG societies. Indeed, it appeared that some modern HG societies (mainly !Kung and Hadza, both

[2] T. Hobbes (1651),*Leviathan, or the matter, forme, and power of a commonwealth, ecclesiasticall and civill.*
[3] Service, E.R. (1966).
[4] Lee, R.B. et I. DeVore (eds) (1968).

located in Africa) were very different from Hobbes-Service's description. Indeed, these societies did not experience scarcity of food and individuals had to do little work to satisfy their limited ends. Therefore, they were labeled as the "original affluent society[5]". Although such affluent HG societies may exist, and probably existed during the pre-Neolithic period, the literature on them has led to two false views. The first one has been to assume that, in prehistory, all HG were affluent, regardless of the period and the area where they lived. This interpretation is false and, furthermore, it does not help to explain the shift from hunting and foraging to farming. A second dubious hypothesis developed by the critics of the modern capitalist system is that human behavior in affluent HG societies is unlike that today. Indeed, some authors[6], claim that affluent HG are not selfish and behave differently from *Homo oeconomicus*. In their economic system, there is no link between production and distribution, and there is a lack of private ownership of property and a high level of dependence on common-property. Their society is egalitarian, and this includes gender equality. Their economy and society are therefore viewed as an example of what societies were like before the advent of market systems and capitalism. Moreover, the capitalist system is also criticized from an ecological point of view. Affluent HG are seen as adopting sustainable technologies and uses of the natural environment. These technologies and uses were adapted to different bioregions and resulted in diverse hunting and gathering practices. However, there is no reason to believe that all (or most) HG societies satisfied these principles.

Moreover, in the 1980s, ethnological studies of past and recent HG societies have shown that if simple HG had existed, they were probably the exception rather than the rule. Indeed, many HG societies were able to have an economic surplus. These societies have been labeled

[5]Sahlins, M. (1974).

[6]E.g. Gowdy, J. (2004).

"complex HG[7]". To obtain a surplus, these societies had relatively complex technologies and kept substantial inventories[8] of items. The construction of some of their items was complicated. Complex HG operated an intensified subsistence economy which exploited a wide range of species and habitats and in many cases, concentrated on a few staple species[9]. As a result of their technologies and their ability to store food, they showed considerable sedentism. They displayed longer annual occupations of specific sites, even permanent occupations, larger and more internally differentiated settlements. Due to their sedentary way of life and their greater amount of available food, their population had a higher density and their tribes sometimes had up to 5,000 members. As a correlate to the distribution of the economic surplus and the increased division of labor, their societies displayed a non-egalitarian allocation of wealth. Status and authority were signaled by the presence of hereditary ranks, incipient classes, or wealth distinctions. In other words, complex HG societies are at the opposite end of the spectrum to simple HG ones and they share all the features of agrarian societies, except that food is not produced. Therefore, complex HG have been widely referenced in the evolutionist literature[10] as providing a bridge between simple HG societies and agrarian societies. Some of them, especially the Natufians (who were located in the Levant) appeared to play a transitional role in the evolution of agrarian societies. The Natufians, as complex HG, gathered wild cereals and, after a while, they domesticated cereals to satisfy their needs, i.e. they introduced agriculture. Others, such as the Scandinavian complex HG (also referred as the North-European Mesolithic HG) exploited marine resources. They are considered to be one of the last complex HG to bravely resist (for a while) the diffusion of the Neolithic revolution.

[7] See e.g. Sassaman, K.E. (2004).
[8] Testart, A. (1982).
[9] It could be marine resources (e.g. in the North-West coast of America, or Scandinavian Mesolithic people in Northern Europe and Jomon culture in Japan), wild cereals (for Natufians in the Levant), or acorns (California).
[10] Finlayson, B (2009).

These three HG societies (simple, affluent and complex) existed prior to the Neolithic revolution, and probably they have existed simultaneously and maybe (at some time) they were neighbors. Explaining the rise of agriculture from a typical HG society is therefore a difficult and uncertain task given the diversity of HG societies described above. In other words, the starting points of the Neolithic revolution differ. Consequently, the features of such revolutions (in different global centers) differ as do the subsequent development paths in places where agrarian revolutions occurred.

3. The Early Development of Agriculture in Different Centers and Patterns of Development

Not only are HG societies diverse, the centers where the Neolithic revolution took place first are also varied. The rise of farming and animal husbandry is clearly documented by archeological studies which demonstrate that in a period which spans from 10,000 to 5,000 BCE, the Neolithic revolution appeared independently in at least seven different locations worldwide: the Levant, North China, Mesoamerica, New Guinea, the Andes, North Africa and India. It is also widely accepted that animal husbandry appeared first in many of these centers, such as the Levant. The reason is that people were initially hunter-gatherers and therefore husbandry allowed them to produce and to store food – livestock – and also to keep their nomadic way of life. However, after few millennia, most of them gave up nomadism; they settled down and adopted agriculture. In these seven original centers, a great diversity occurred in the nature and number of plants and animals that were domesticated. In the case of plants, cereals (wheat, barley, rice, quinoa, maize) were the most common domesticates but were not present everywhere. In New Guinea, there were no cereals (the main domesticated plants were taro and bananas). Similarly, the most common animals

domesticated[11] were sheep, goats, cattle, pigs and chickens. However, in the Andes, only llamas were domesticated. Pigs and chickens were probably first domesticated in China and were then introduced to other places. Substantial differences occurred in the availability of plants and animals where agriculture started. Indeed, there was little in common between the Mediterranean ecosystem of the Levant, the tropical forest of New Guinea and the highlands of Peru. Therefore, local ecogeographic conditions do not help in understanding (as a global phenomena) the transition from foraging and hunting to farming. Indeed, a precondition – or a necessary but not sufficient condition - for the development of agriculture and/or animal husbandry would be the presence of wild plants or animals suited to domestication and in the case of plants, climate conditions supportive of their cultivation. For example, neither agriculture nor animal husbandry were developed in Australia because there was a lack of plants suitable for domestication, no suitable animals for this purpose, and a climate unfavorable to agriculture.

For more than a century, pre-historians have tried to answer the following central question: Why did modern humans (Homo sapiens) after being hunter-gatherers for more than 99% of their existence, decide to produce their food from about the beginning of the Holocene era. Unfortunately, there is no unique answer, i.e. no unique or unified theory which can explain all the transitions that have been documented until now. In others words, here again the origins or reasons of the Neolithic revolution are diverse. This diversity of the theories about the Neolithic revolution could be explained by the diversity of the facts and artifacts observed worldwide by archaeologists, as mentioned above. However, it is also, and mainly, a result of various visions or schools of thought existing in the literature about prehistory. Two main visions are at work, and depending on the period considered, their popularity has varied.

[11]We do not consider here the domestication of dog; it began earlier but was mainly motivated to ease human hunting activity rather than to provide food.

The first one is based on social evolutionary theory. Here, the production of food is explained by human adaptation to external shocks. Many external shocks are possible (e.g. animal extinction due to overkill or disease) but the most popular one currently is climate change and the induced transformations of ecosystems. This explanation is probably the most popular because past prevailing climate and ecosystems are nowadays perfectly known by means of various techniques, such as radiocarbon dating. Others features of the past, such as the population size, the degree of competition among neighboring tribes are at best hypothesized. As it is usual in the evolutionist approaches (in the biological or the social domains), evolution is assumed to transform simple systems to complex domains and climate change is the perfect candidate for that purpose. The rise of agriculture could be humanity's response to a climate change resulting in a better or to a worse environment (altering the availability of food for humans). In the former case, the resulting ecosystems support more abundant and diverse plants and animals. As a result, food procurement is easier for HG who therefore have more time for leisure and for experimenting with cultivation and the domestication of plants and animals. They may settle and have more children[12]. In the latter case, the resulting ecosystems are worse than before, with greater scarcity of food resources, for example, as a result of a drought. In order to survive, i.e. to avoid starvation and death, HG must find new ways to get food and this may have led to the start of agriculture[13]. These simple alternatives show that the start of agriculture can be the result of various external shocks (positive or negative) even when these shocks all arise from climate changes.

The second vision considers that people did not primarily change their livelihoods as a result of external shocks. They decided, in an endogenous manner, what to do, i.e. to forage, hunt or to farm. This cultural approach is much more common among neoclassical or mainstream

[12]This case can be illustrated by the way of life of complex HG (e.g. Natufians).
[13] V.G. Childe (1936) and his « Oases theory" is based on such scheme.

economists and is also typical of human behavioral ecology[14]. Following J.L. Weisdorf (2005), the Neolithic transition can be explained (from an economic point of view) as involving a simple choice between techniques to get food, namely between foraging, hunting and farming. This choice is made by humans and is based on a simple cost-benefit analysis: people compare the productivity of their labor in alternative economic systems. As long as foraging provides higher labor productivity, people remain hunter-gatherers. Even if they already know how to domesticate plants and animals[15], they do not. When labor productivity becomes less in foraging than in farming, some HG turn to agriculture and for a while adopt both techniques. When the gap between the two labor productivities grows large, most people shift completely to agriculture and the Neolithic revolution is under way. Various explanations of the changes of labor productivity can be given. Some are exogenous, like climate change, some are purely endogenous, like the implementation (enforcement) by agriculturists of property rights, and one (namely population pressure) can be viewed as exogenous and endogenous. The two views on population pressure are the following ones. For Malthus, the population growth is limited by the quantity of food produced by agriculture. Here, population pressure is considered as exogenous. But, if one considers that the quantity of food produced by agriculture is increasing with innovation and that the latter is positively stimulated by population pressure, we get the opposite conclusion. In this Boserupian[16]view, population pressure is clearly endogenous.

4. 'Economic' Conditions Needed for the Development and Sustainability of Agriculture: Property Rights and Comparative Benefits

The rise of agriculture requires at least three different groups of conditions. The first group of

[14]Winterhalder, B. and D.J. Kennett, (2006).
[15] As F. Pryor (2004) has suggested, HG have learnt about nature during millennia; therefore they have progressively adopted practices that were proto-agriculture.
[16]Boserup, E. (1965).

conditions is about the existence of appropriate natural ecosystems, i.e., as explained previously, the existence of plants and animals that are suitable for domestication and which enable increased productivity of labor to be obtained. The second group encompasses the presence of tools and techniques that are necessary for the development of agriculture. If we refer to the cultivation of cereals, the corresponding tools are, for example, those necessary for harvesting cereals (a sickle) and for transforming the harvested grains into flour (grinder, mortar). It should be noted that these tools were made by people before the start of agriculture. In the Levant for instance, Natufians were harvesting wild cereals and therefore had introduced these new tools before they became farmers. Similarly, all complex hunter-gatherers (as were Natufians) introduced new techniques in order to store food. For cereals, it was the introduction of pits while for others having abundant fresh food (such as meat or fish), storage was possible by means of desiccation or smoking. The mastery of these tools and techniques was clearly necessary for initiating agriculture. Some other techniques (such as those related to irrigation) were introduced after agriculture developed. The third group of conditions is about institutions or organizations among people. These are necessary to manage collective tasks such as harvesting and irrigating the fields or even the implementation of the division of labor between agriculturists and other forms of work of social value.

Following the definition given by D. C. North (1981, 201-2), institutions are “a set of rules, compliance, procedures, and moral and ethical behavioral norms designed to constrain the behavior of individuals.” In a later essay (1998: 81), he added: “If institutions are the rules of the game, organizations and their entrepreneurs are the players. Organizations are made up of groups of individuals bound together by some common purpose to achieve certain objectives. Organizations include political bodies, economic bodies, social bodies and educational bodies”. Although these examples focus on industrial, rather than pre-industrial economies,

North's basic idea can be applied to all economies. During the shift from foraging to farming, one of these institutions has been crucial: the introduction (enforcement) of property rights, especially those related to land ownership. Before the Neolithic revolution, private property already existed but was limited to personal items (tools, clothes, weapons) or to very particular and rare land areas were wild staples were abundant (e.g. a coastal area with abundant shellfishes). But, for most food resources, such as plants and game, there was no private property. During the Paleolithic, many simple HG were probably living in an open-access system. In this system of *res nullius*, the lack of property is associated with very low productivity – no one has an incentive to invest - and there is a tendency to unrestricted use and therefore to overexploitation. Probably, the extinction of the megafauna[17] is the result of overkill. During the Mesolithic period, in most complex HG societies, common property existed. This system of common property (or *res communis*) can result in optimal resource use but only when it involves appropriate local communal governance[18.] With the introduction of agriculture, this system of collective property became impossible. Farmers had to work most of their time in their fields, plowing, sowing, irrigating, removing weeds, harvesting. In other words, agriculture required an important investment; it is a deferred-return economy while hunting-gathering involves primarily an immediate-return economy[19]. It was therefore obvious that farmers, in order to protect their investments, favored the introduction and the enforcement of private property rights. This was especially so for privileged or dominant classes. It seems they often resorted to force or threats of force to maintain or to expand their property 'rights'.

As stated by D.D. North and R.P. Thomas (1977, p 230), "The key to our explanation (of the transition from foraging to farming) is that the development of exclusive property rights over

[17]Smith, V. L. (1975); Bulte, E, R. D. Horan, and J. F. Shogren, (2006).
[18]Ostrom, E. (1990).
[19] Except for the economy of some complex HG societies where food procurement first necessitates some investments (e.g. building a weir in a river to catch fishes).

the resource base provided a change in incentives sufficient to encourage the development of cultivation and domestication". This, however, required the ability to enforce such rights. At the very beginning of agriculture, when it was still very experimental, the quality of resource endowments were probably more important than any other factors for agriculture to emerge. But after a while, and in order to become a complete system able to feed people and an alternative to hunting-gathering, the role of institutions and especially of property rights, became crucial.

5. The Geographical Spread of Agriculture: Demic Diffusion and Imitation

Current evidence suggests that the Neolithic materialistic culture was introduced to Europe via western Anatolia. All Neolithic sites in Europe contain the plants and animals domesticated in Southwest Asia: einkorn, emmer, barley, lentils, pigs, goats, sheep and cattle. Genetic data suggest that no independent domestication of animals took place in Neolithic Europe, and that all domesticated animals were originally domesticated in Southwest Asia. It is therefore widely accepted that the onset of agriculture in the Near East triggered a cultural change that diffused farming and associated technologies across Europe starting about 10,000 years ago. The information provided by archaeological remains and the trajectory of straight and short line paths suggest the estimated speed of agricultural spread was approximately 1 kilometer per year[20]. Of course there were very significant regional variations in the rate of spread, e.g. unfavorable ecological and geographical factors caused a retardation of its spread to some part of Europe.

Hence, two alternative demographic scenarios have been proposed to account for this transition. Despite their fundamental differences, both processes in fact represent gradual spread driven by individual random events, either human migrations or cultural exchange

[20]Ammerman, A.J. and L. L. Cavalli-Sforza, (1971).

events. In the demic diffusion model[21], the spread of technologies involved a massive movement of people. The demic diffusion is a kind of replacement model. It posits that there was a significant migration of farmers from the Fertile Crescent into Europe. Given their technological advantages, these migrants would have displaced or absorbed the less numerous hunter-gathering populace. Thus, modern Europeans are primarily descended from these Neolithic farmers, which implies a significant genetic input of Near Eastern genes from Neolithic farmers. Given the cultural diffusion model, on the contrary, the transition to agriculture is regarded essentially as a cultural phenomenon, involving the movement of ideas and practices rather than people. It is then assumed that agriculture reached Europe by way of a flow of ideas and trade between the Mesolithic European population and Anatolian farmers. There was no net increase in migration during this process, and therefore, modern Europeans are descended from the "original" Palaeolithic hunter-gatherers. Consequently, the cultural diffusion model does not imply major changes in the composition of human genes in Europe as a result of migration from Asia Minor.

Proponents of both models acknowledge that there is a spectrum of intermediate scenarios involving mixed models: settlements were founded by a mixture of farmers whose ancestors originally came from the Near East and indigenous hunter-gatherers. The question is, therefore, whether the dispersing farmers were few, as in the cultural diffusion model or many, as in the demic diffusion model. Most recent studies[22] show that cultural diffusion explains between 30 to 40% of the spread rate of the Neolithic transition in Europe, as implied by archaeological data. Thus, cultural diffusion cannot be neglected, but demic diffusion was the most important mechanism in this major historical process at the continental scale. However the demic diffusion and the cultural diffusion models may represent false dichotomies and mixed models seem to be more relevant. The mixed model

[21] This model has been first introduced by Ammerman A. J. and L.L. Cavalli-Sforza, (1984).
[22] J. Fort (2012).

postulates that there was an initial, small-scale migration of farmers from the Near East to certain regions of Europe. They might have enjoyed localized demographic expansions due to social advantages. The subsequent spread of farming technologies throughout the rest of Europe was then carried out by Mesolithic Europeans who acquired new skills through trade and cultural interaction.

It should be noted that the dominance of the demic diffusion model is not specific to the spread of agriculture in Europe. Indeed, the same conclusion holds for the spread of agriculture in China where it emerged initially along the Yellow River, an area where Han populations were living. Various genetic studies of Han populations demonstrate that the pattern of the southward expansion of Han culture is consistent with the demic diffusion model, and that males played a larger role than females in this expansion. The Han people, who all share the same culture and language, exceed 1.16 billion (2000 census at the world level), and are by far the largest ethnic group in the world.

Demographic pressure is generally considered to be the prime mover of the Neolithic expansion. The Ice Age hunter-gathering groups existed in an equilibrium eco-social system; and they were able to control their population in response to variations in food supply. Thus, births were normally spaced at 3–5 year intervals among nomadic hunter-gatherers and the maximum potential fertility per woman was reduced to 3–5 children and often further diminished by infanticide and high mortality. Judging from the number of sites, the population in the Near East started increasing from 15,000 B.C.E. with the appearance of Natufian sites. This was marked by an increase in sedentariness and a broadened range of subsistence strategies. Apparently, the birth rate dramatically increased with the emergence of agricultural sedentary settlements. This is believed to be due to the changed social status of women and to better childcare, combined with the larger and more regular availability of a

more nutritious food supply.

Although since Childe (1936), mass migration from western Asia was deemed to be dominant mechanism for Neolithic expansion into Europe, one may attach greater significance to the indigenous adoption of agriculture, described as cultural diffusion, driven by contacts between invading farmers and local foragers. Indeed, it is well documented[23] that exchange and trade over long distance[24] occurred from the Mesolithic period onwards. Economic purposes, such as the ones involved in trade, are some of the main contributors to cultural diffusion. Such a claim is supported by the rapid spread of pottery production (during the Neolithic period) and of metalworking (after the Neolithic period) from the Levant to Europe as a result of trade.

From an economic point of view, the demic diffusion and the cultural diffusion approaches are quite different. The demic diffusion model is clearly based on social evolutionism. In fact, HG and farmers are seen as two "human species" competing for land, i.e. for food resources provided by land. After a while farmers win this competition and HG are converted to agriculture or remain HG but are confined to marginal areas unsuitable for agriculture. In the cultural diffusion model, the main vector of agriculture diffusion is trade. Since HG and farmers are free to be involved in trade or not, the final conversion of HG to farming is induced by trade. The associated exchange of ideas and techniques is the result of cooperation between these two "human species" and is not one of competition.

[23]Grantham, G. (2006).
[24] For instance, stone-tools made from obsidian have been found in Europe and the Levant at several hundred kilometers from the volcanic areas they were coming from.

6. The Generation of an Economic Surplus from Agriculture: Capital Accumulation, the Use of the Surplus and Economic Growth

The societal changes brought about by farming eventually had two key consequences: it resulted in a sedentary lifestyle, and a food surplus. In hunter-gatherer societies, women needed a gap of at least three to four years between children, as multiple, highly dependent babies are incompatible with a mobile lifestyle. No such limitation existed when people lived in permanent settlements, and since farmers needed to settle close to their fields, it became possible for women to have children much more frequently. Additionally, as the techniques of plant cultivation and animal husbandry became more refined, it was possible to feed entire groups of people from relatively small numbers of food-sources, and still have food left over for storage during the off season. People in agricultural communities were less subject to the whims of nature than HG and thus had a higher chance of survival. Thus, a population explosion was possible but in some agropastoralist societies, a privileged or dominant class appropriated much of the economic surplus (from agriculture) and this moderated population increase (compare Tisdell, 2013, Ch. 7). The surplus enabled villages, then towns, and eventually cities, to take shape.

Another effect of the food surplus was that not everybody needed to be involved almost solely in the activity of finding and preparing food. People now had more time to do other things and some people were at liberty to dedicate themselves entirely to other pursuits. New skilled professions were born such as tool-making, milling, pottery, weaving, and carpentry, to name a few. In other words, the increased labor productivity associated with agriculture production allowed a more intensive division of labor. Thus, the Neolithic Revolution gave rise to accelerated technological progress compared to its speed in HG societies.

Although trade was already a feature of hunter-gatherer societies, with the development of

farming, it increased greatly in its scope and scale. As it is well known from Adam Smith's seminal work[25], the division of labor is based on work specialization. The more work is specialized among people, the more trade is required. With excess food and newly created specialist crafts available, societies had a greater capacity to produce goods of value to others. A new class of specialists emerged to facilitate the exchange of goods: the merchants. In many cases these people became enormously wealthy and powerful. Inequality had arrived, from trade but also from other sources, such as land ownership, and a whole new set of systems and structures would be required to deal with this.

The initial effect of the shift from hunting-gathering to agriculture was an increase in food production. Societies that adopted agriculture were able to produce far more food in a given territory than those that relied on foraging. This increase in productivity could be used either to expand the economic surplus or expand population, with both usually occurring. Beyond the population growth, the most important consequence of the greater economic surplus was further growth of the State and of the power of the governing class that controlled it.

Another significant development in these agrarian societies was (it seems) a marked slowdown in the rate of technological innovation and progress[26], beginning within a few centuries after the shift from HG to horticulture and then to agriculture. This was due largely to the negative feedback generated by the major technological advances, as the ruling class became detached from the subsistence technologies and fought to maintain their status quo[27].

[25] *An Inquiry into the Nature and Causes of the Wealth of Nations: A Selected Edition* Adam Smith (Author), Kathryn Sutherland (Editor), 2008, Oxford Paperbacks, Oxford, UK.

[26] "*The two thousand years after the revolution - say from 2600 to 600 B.C. - produced few contributions of anything like comparable importance to human progress. Perhaps only four achievements deserve to be put in the same category as the fifteen just enumerated. They are: the "decimal notation" of Babylonia (about 2000 B.C.); an economical method for smelting iron on an industrial scale (1400 B.C.); a truly alphabetic script (1300 B.C.); aqueducts for supplying water to cities (700 B.C.)*". But only two of these four discoveries can "*be credited to the societies that had initiated and first reaped the fruits of the urban revolution*", V.G. Childe (1936, p 257-8).

[27] P. Nolan and G.E. Lenski (2008, chapter 8).

Despite the eventual and temporary slowdown in the rate of technological innovation, Neolithic societies experienced economic growth based on the economic surplus generated by agricultural production. Indeed, the increase over time of the population sizes of these societies demonstrates that the Neolithic societies experienced economic growth. Beginning in the Neolithic period, economic growth is the result of three main sets of factors, of which the occurrence of social and economic inequalities are very important. The first involves the initial conditions required for economic growth as a result of agricultural development. These include favorable ecogeographic conditions and available genetic resources (plants and animals) suited to domestication[28]. The second set involves the scope for capital accumulation and for technological progress[29]. The third set of factors involves the presence or absence of social, inequality. In some Neolithic societies, significant social inequality existed. In these societies, an elite or a ruling class captured part of the economic surplus in the form of various taxes or equivalents.

The way in which this appropriated surplus was used by the dominant class was crucial for economic growth. The available surplus for the privileged class could be used in different ways. It could be used for productive investments (such as the provision of infrastructure including irrigation works, the support of education and research activities, improvements in public administration and so on) or for extravagant consumption by the privileged class. A further important possible disbursement of the surplus was for armed forces to defend the property rights of the privileged class or extend these rights. This was relevant to both to conflict within many societies as well as to excluding potential external enemies and of value for the seizure of external territories. The economic fate, growth and survival of societies depended on the size of the economic surplus appropriated by the dominant class and the way in which it was allocated between these types of activities; that is between productive

[28]As explained, for instance, by J. Diamond (1997).
[29]Both causes were at the center of economic growth theories during the mid-twentieth century.

investment, consumption by the elite and spending on armed forces, including equipment and services to support these forces. However, for most (all) societies, there was in the end no combination of these factors that ensured their survival as independent entities in perpetuity, for example, no combination sufficient to protect them completely from being overcome by invading foreign forces. Consequently, in earlier agropastoral societies, property rights maintained by force were not stable and their maintenance sometimes imposed a debilitating economic cost on these societies. Fortunately, within most modern societies, the cost of maintaining private property rights is much lower than in earlier societies.

7. The Global Dominance of Agro-Industrial Societies – Their Eventual Domination of HGs and Agropastoralists

For a long time ago, economists have explained the economic growth, development and wealth of nations by reference to the economic history of these nations rather than features which evolved in pre-history. During the last two decades, economists have been more concerned with stone age economics and more specifically with the so-called “Neolithic revolution” and its long-run consequences. This growing interest stems mainly from J. Diamond’s (1997) influential work. For this author, differences in the levels of economic development of nations observed today find their roots in prehistory. More precisely, the key factor for Diamond is about the time at which people started to produce their food, i.e. when they shifted from hunting-gathering to agriculture and animal husbandry. Since the seminal work of V.G. Childe (1936), this shift is considered to be the core of the Neolithic revolution. The latter resulted in major changes for humankind since it is during this period that the foundations of modern civilization (such as the formation of cities and States, the introduction of writing and of mathematics, the development of craft industries and of trade networks) are assumed to have originated. Therefore, following Diamond’s contribution,

many economists have tried to explain the path of economic growth from an historical perspective starting from the Neolithic revolution. These works all consider the Neolithic revolution to be the starting point for economic growth and they emphasize the role of various key variables such as geography and resources endowments[30], institutions[31], technology[32], in the evolution of mankind[33].

According to these recent works, the transition from hunting and gathering to farming is viewed as a necessary and sufficient condition for human societies to develop and for economic development to occur. It is believed that the rates of economic, technological, and political development of the world's societies are fairly well predicted by the presence or absence of early agricultural development and the associated growth of population densities and social complexity, including larger scale polities and more complex divisions of labor. The main question is about the timing and nature of this transition and subsequent development[34].

It has been argued that three cases exist[35]. First, where agriculture started early (as in China, India, West Asia, the Mediterranean basin) it resulted in dense populations, tax collecting states, and cities. Second, relative newcomers to agriculture, such as Mesoamerica and Peru, in the New World lagged behind the Old World in key technologies. Third, lands without agriculture (Australia, Southern Africa, eastern and southern South America, and the far north of both hemispheres) and those areas with less productive agricultures (New Guinea, Polynesia) lagged behind in population growth and technological development.

We challenge this vision. Food production (i.e. agropastoralism) is not a sufficient condition

[30]Easterly, W. and Levine, R. (2003).
[31]Acemoglu, D. and J. Robinson, (2012),.
[32]Comin, D, W. Easterly, and E. Gong, (2010).
[33]Galor, O. and O. Moav, (2001, 2007).
[34]Chanda, A. and L. Putterman (2007).
[35] J. Diamond (1997) ; Chanda, A. and L. Putterman (2007).

for the human societies to develop and some development is possible even in the absence of food production. Furthermore, agriculture in the form of horticulture developed very early in New Guinea, Meso-America and South America[36] but it did not result in nearly as much economic growth as in Eurasia. Four different situations help to explain our point of view.

First, it was possible to cultivate for some people, but they did not. For example, Australian Aborigines were harvesting wild yam but they never cultivated it. Nonetheless, it's cultivation on its own would not have supported settlement, other species which could be domesticated were rare and ecogeographic conditions were not very favorable to the initial development of agriculture in Australia. However, it should be noted that Australian Aborigines "husbanded" nature. They developed a selective firestick culture which helped them with their harvest of wild foods and favored some species which they valued. This example shows that determining whether a society practices "agriculture" or not raises some problems[37]. Agriculture involves both modifying the environment (i.e. cultivation) and manipulating the genetic material of plants or animals (i.e. domestication) to increase the labor productivity of obtaining food. For plant production, agriculture involves several distinct tasks: preparing the land and planting; certain nurturing activities such as fertilizing, irrigating, weeding and warding off predators; and, finally, harvesting and the selection of seeds to store for next year. To decide where the line should be drawn between agriculture and related subsistence activities, some distinctions need to be made. Many activities (firestick culture, soil aeration, watering fields) are proto-plant-production or proto-agriculture since they place a greater emphasis on managing the environment for plant production, rather than on nurturing the crops or deliberate manipulation of the genetic materials of the plants. Secondly, some human societies have developed without being agrarian societies. They have developed food production based mainly, or exclusively, on

[36] C. Renfrew, (2007).
[37] Pryor, F. (2004).

animal husbandry involving pastoral nomadism. Of course it can be said that pastoral nomadic groups have interacted with agriculturists (often in a symbiotic way[38]) and that some of them finally have adopted a sedentary way of life. However, many remained nomads and then developed their own society, different from those of agriculturalists. In these societies, people were aware of what agriculture was but they decided to remain nomads for centuries (and some such pastoral nomads still exist today). It should be noted that in some areas, especially given early agriculture, available climatic conditions, did not suit settled agriculture. Locations had to be changed to take advantage of changing weather (rainfall and/or the melt of snow) in different areas, and pastoral nomadism was well adapted to such conditions. Their choice can be partly explained by the existence of externalities: indeed, their mobility was considered as a fundamental advantage from a military point of view, in order to attack or for their defense. It was the greater ability of the nomadic groups to learn and adapt new technologies that ensured their survival and military superiority (for a time) after the domestication of the horse.

Early societies utilizing horticulture[39], could be considered as another example of a human society displaying its own development over time. In such a society, people cultivate plants but they do not plow. In all places, plowing using animal power was not an initial feature of the commencement of agriculture but a later development in some centers like in Eurasia (using oxen and donkeys) and Asia (with buffalo). Sometimes, and even after the beginning of horticulture, plowing was still not used. It was the case, for example, in the Andes and it was because no local animal was suited for developing animal-drawn plows. In other cases, located in tropical forests, plowing was possible but without interest because the soil was too

[38] The example of Aryans in India and Persia, Hittites in Turkey, Hyksos in Egypt, Minoans and Greeks in Greece are some well known cases of pastoral nomadic communities catalysing the birth of great civilizations.
[39] Some of these horticultural societies have existed for a long time. For instance, in the Andes people were able to cultivate (for example, maize, tomatoes, peppers). However, the local animals they domesticated (namely llamas) were not suited for the use of plow.

poor and eroded by tropical rains. Therefore, in such environment people develop the so-called "slash and burn" technology. Its purpose was to let land that has been cultivated remain fallow and regenerate before being used again for growing crops. This "shifting agriculture" was also practiced in other places (including Europe, where it is called "swidden agriculture") even many centuries after the Neolithic revolution. In Amazonia, Yanomani are very famous horticulturists who have retained their way of life– they cultivate gardens[40] – and not fields – and also hunt wild animals.

Thirdly, in some cases, people grew crops and husbanded animals but this did not lead to the development of human society of the type that evolved from the Levant. In New Guinea, people domesticated pigs and cultivated taro and banana. However, the human society that emerged there following the Neolithic revolution did not develop in the way societies based originally on agriculture did in Eurasia. For example, major towns and cities never evolved.

In Mesoamerica[41] and in the North America (the Mississipi basin and the valley of Ohio river) the Neolithic revolution gave rise to human societies which, after a while, collapsed without obvious reasons. In other words, these human societies, which were assumed to have technological and institutional advantages, i.e. to be superior, should have developed over time and should not have collapsed.

Fourth, the collapse mentioned above may be explained by external shocks such as diseases, environmental catastrophes or wars. It could also be explained by human endogenous decisions. Indeed, even when food production and sedentism were well established, reversion to hunting and gathering was still possible, depending on opportunity costs. Some examples

[40] In Latin language, *horti* means garden.

[41] Olmec civilization appeared suddenly around 1200 BP without much evidence of gradual development. The Olmecs possessed irrigation systems, monumental architecture, calendrical and writing systems, religion, and urbanism. The earliest Olmec sites were located in the tropical forests of the Gulf coast of eastern Mexico, but Olmec culture spread inland to the highlands. Maize cultivation provided the basis for a state ruled by a hereditary elite dependent on the maintenance of organized religious ceremonialism.

of reversion in North America are well documented[42]. In this area, the (re)-introduction of horses by conquistadors caused some north-American native Indians tribes[43] to revert to hunting as a permanent way of life. Another example of reversion concerns the Levant and is about the well-known Natufians. Indeed, it appeared that the late Natufians reverted to a higher degree of mobility after having adopted a settled life. Decreases in site size, the decline of architecture, as well as changes in the burial record have been seen as indicators of increased mobility. It is suggested that the reason for higher mobility during the late Natufian was the climatic deterioration which occurred with the onset of the Younger Dryas, which depleted available resources. This, in turn, resulted in a dispersal of populations across the region to maximize their returns from different areas and alleviate risk.

In addition to these four situations described above and in order to illustrate why agropastoralism is not a necessary and sufficient condition for human societies to develop into societies sustained by agriculture, one can add that the economy and social structures of many societies were quite developed before the shift to agriculture, i.e. during the pre-Neolithic period. It appears that the development of economies, and especially of economic behaviors, was important and even crucial during the Paleaolithic period[44]. Indeed, the endogenous division of labor and subsequent trading among early modern humans (*Homo sapiens)* could have helped them to overcome potential biological deficiencies, and therefore lead to the demise of Neanderthals. In other words, there is a relation between economics and natural selection, and trade (i.e. the cultural dimension of human societies) which may partially offset natural selection.

Many pre-Neolithic hunter-gatherers societies, and probably most of them, were in fact

[42] See Smith, V.L. (1993, p 17-18).
[43] Cheyenne, Arapaho.
[44]Horan, R. D., E. Bulte, and J. F. Shogren, (2005).

complex[45](i.e. people were affluent[46]) had a sedentary way of life, the population was quite numerous (as tribes) and the society was often based on hierarchical groups including elites. Even without food production by means of farming or rearing, some HG developed complex societies that were very similar to those of agriculturalists. In some cases (such as in California and on the North-West coast of America) these societies were still flourishing a few centuries ago. In other words, many pre-Neolithic economies[47]were quite developed (and displayed division of labor, trade, wealth accumulation, land ownership) and therefore were similar to Neolithic ones, even if less intensively developed.

For the development of human societies and of their economies, the past is important for explaining the present. However, the starting point of human development is not the Neolithic period – even if this period is quite important from an economics point of view. During the pre-Neolithic period, the economy and the society were sufficiently developed, to give rise to the Neolithic revolution. It is therefore during this pre-Neolithic period that the roots of our institutions, our technology and so on, were established and their influence still continues. Preconceived notions about the transition from simple hunter-gatherers to complex collectors and farmers have therefore hindered progress in appreciating the diverse and knowledgeable ways in which HG operated within their habitats and ecosystems. This is because social evolution is considered to exist *a priori* as a cross-cultural principle, which necessitates a unilineal progression from simple adapted forms to more complex social systems.

8. Discussion and Conclusion

We have seen that the Neolithic revolution is featured by a transition from foraging and

[45]Price, T. D., and J. Brown, (1985).
[46] Even if they did not produced food, they had plenty of food and were able to store it. See A. Testart (1982).
[47]Svizzero, S. (2014).

hunting to farming and that both economic systems (food procurement and food production) have advantages and drawbacks. However, agriculture has virtually replaced hunting and gathering globally and these forms of gaining a livelihood are now found only in very marginal and supposedly "backwards" areas like New Guinea.

To explain the dominance of agrarian societies, it is important to take into account the social and economic inequalities induced by the Neolithic revolution. Indeed, inequality was a necessary condition for the survival and development of these societies; otherwise they would all have been caught in the Malthusian trap. It was economic success with the development of agriculture in Eurasia which, when combined with inequality, provided the basis for further economic growth and increasing wealth in Eurasia and eventually the industrial revolution. However, it was probably not just the initial conditions that resulted in Eurasian global dominance eventually. Subsequent events played a role. For instance, the fact that grains were the early basis of agriculture in Eurasia was advantageous for the development of societies basing their economies on grain production. This is because cereals are stored relatively easily and transport easily compared to fruit and vegetables. They are, therefore, tradable over long distances and could be stored over time. They can be collected as ‘taxes’ and used as medium of exchange. They can support urbanization. New Guinea did not have grains and it had a social system involving equality. As a result, it did not ‘develop’ as in Eurasia.

In most cases, agriculture eventually produced a growing economic surplus. When this was appropriated by the elite (a dominant class) and used in specific appropriate ways, it increased the power and wealth of these societies, albeit a solution based on unequally distributed wealth. While this is not the only factor in the growing dominance of agriculturally based societies, it is one of main ones. For example, a population of near

starving farmers at subsistence level would be little match in a battle with well-nourished H-G. Furthermore, in war, it was increasingly the case that new technologies, not numbers became decisive. In Eurasia, new defense and attack technologies developed fairly rapidly after the agrarian revolution. This was only possible in societies where inequality existed. Inequality was therefore a necessary condition for the survival and development of these societies; otherwise they would all have been caught in the Malthusian trap. However, inequality is not a sufficient condition for the sustainability and development of such societies. If the elite (the dominant class) squander the surplus they appropriate, their societies are liable to collapse.

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